

T. Kroc

October 3, 1989

X-ray Radiation Survey of the Drift Tube Linac

On September 29, 1989, a survey was made of the x-ray radiation produced by the electric fields in the present linac. The highest dose rate was 1 R/Hr at the high energy end of tank 6 which has the highest operating surface fields.

Measuring equipment : Victoreen 440RF/A, Fermi SN T7, calibrated 9-26-89

Measurment location : upstream endbell of each tank, approx. 1 ft from outside surface of tank and at the east wall of the tunnel, approx. 6 ft from tank. (see fig. 1)

Gradients sampled : .5, .7, \approx .95 of the original operating gradient for the tank of interest, all others at .25 of operating gradient.

The data are shown in the table at the end of this report. Figure 2 shows the 1 foot data and Figure 3 shows the data taken at the wall. The x-axis is the peak surface field of the last cell in the tank.

The minimum dose rate that the Victoreen could measure was .1 mR/Hr. The 1 foot distance was estimated. The errors on the measurements are assigned to be 100% at or below .2 mR/Hr and 50% above .2 mR/Hr.

Only the full gradient measurement was made for tank 4 as it was expected that the background radiation from the activation from NTF would affect the other measurements. Figures 2 and 3 indicate that even at full gradient, the radition from activation is a significant part of the measured dose rate. The figures also show that at 50% of full gradient, the measurements for tanks 3 and 9 have been affected by the activation background.

The dotted line in Figures 2 and 3 is a fit to the rise in the measured dose rate as function of the electric field in the cavity. For the one-foot data this dependence is: Dose rate = $E^{11.5 \pm 0.9}$. For the data taken at the wall: Dose rate = $E^{12.7 \pm 2.3}$.

The operation of the purple radiation mars lights was checked. They turn on when the gradient is between .5 and .6 of the operating gradient. This gives a dose rate of .5 mR/Hr or less at 1 foot due to x-rays.

Radiation from Drift Tube Linac

Measured Data

Tank	Fraction of full gradient	E_{\max} (MV/m)	Dose at 1 foot (mR/Hr)	Dose at wall (6 ft) (mR/Hr)
1	.5	5.1	<.1	-
	.7	7.1	<.1	-
	.95	9.6	1.1	-
2	.5	4.8	.2	.1
	.7	6.8	.2	.15
	.97	9.4	.4	.4
3	.5	6.4	.4	.15
	.7	9.0	1.1	.35
	.94	12.5	140.	39.
4	.94	12.4	300.	46.
5	.5	7.0	<.1	<.1
	.7	9.9	3.	.1
	.94	13.2	83.	.8
6	.5	7.1	.1	-
	.7	9.9	17.	2.6
	1.0	14.2	1000.	195.
7	.5	7.2	.1	-
	.7	10.0	2.7	.8
	.95	13.6	145.	50.
8	.5	7.2	.15	-
	.7	10.2	1.65	.5
	.91	13.2	80.	31.
9	.5	7.4	2.3	.4
	.7	10.4	12.	2.3
	.95	14.1	265.	68.

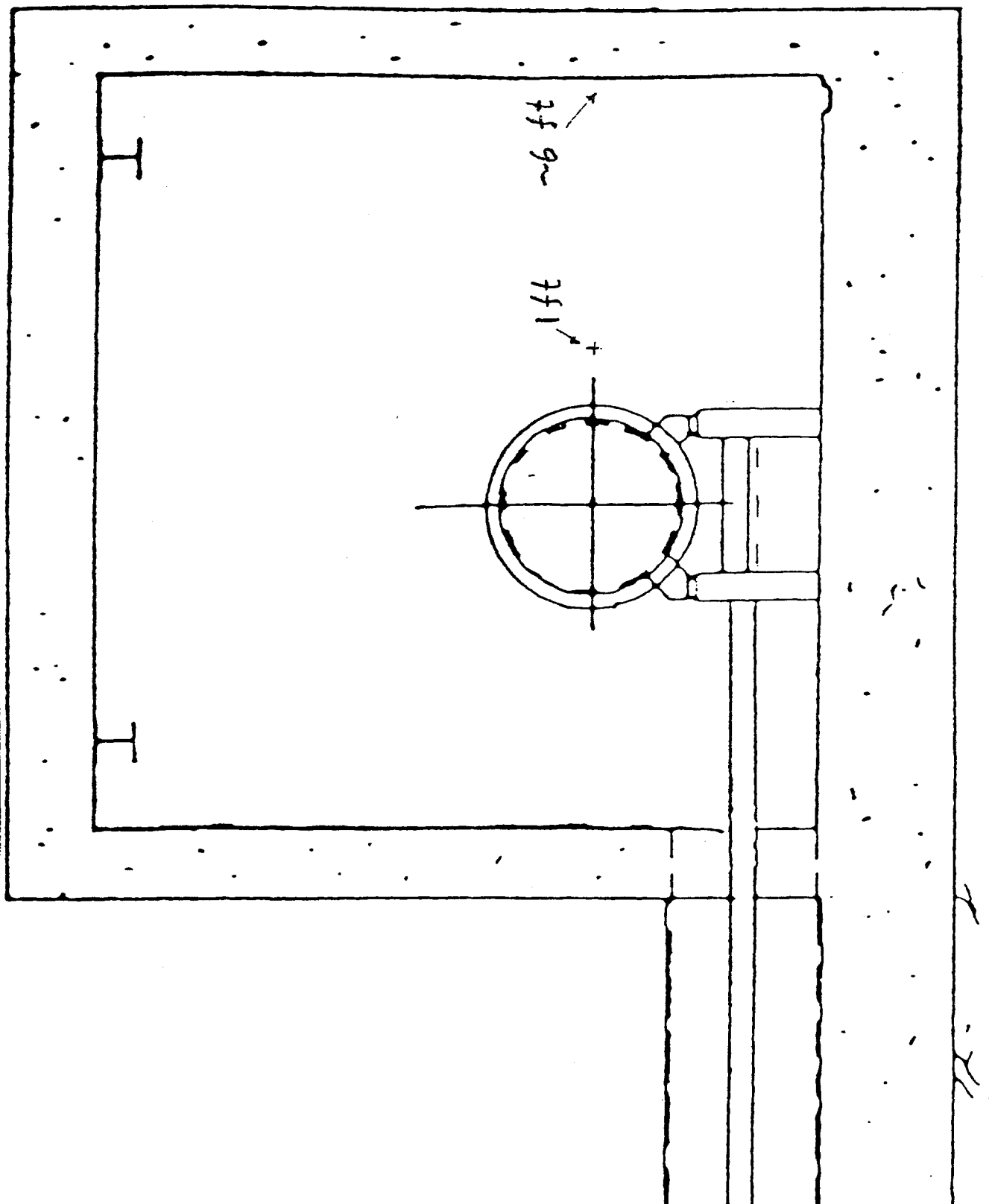


Figure 1

X-ray Radiation from Drift Tube Linac at 1 ft

3-OCT-1989 08:52

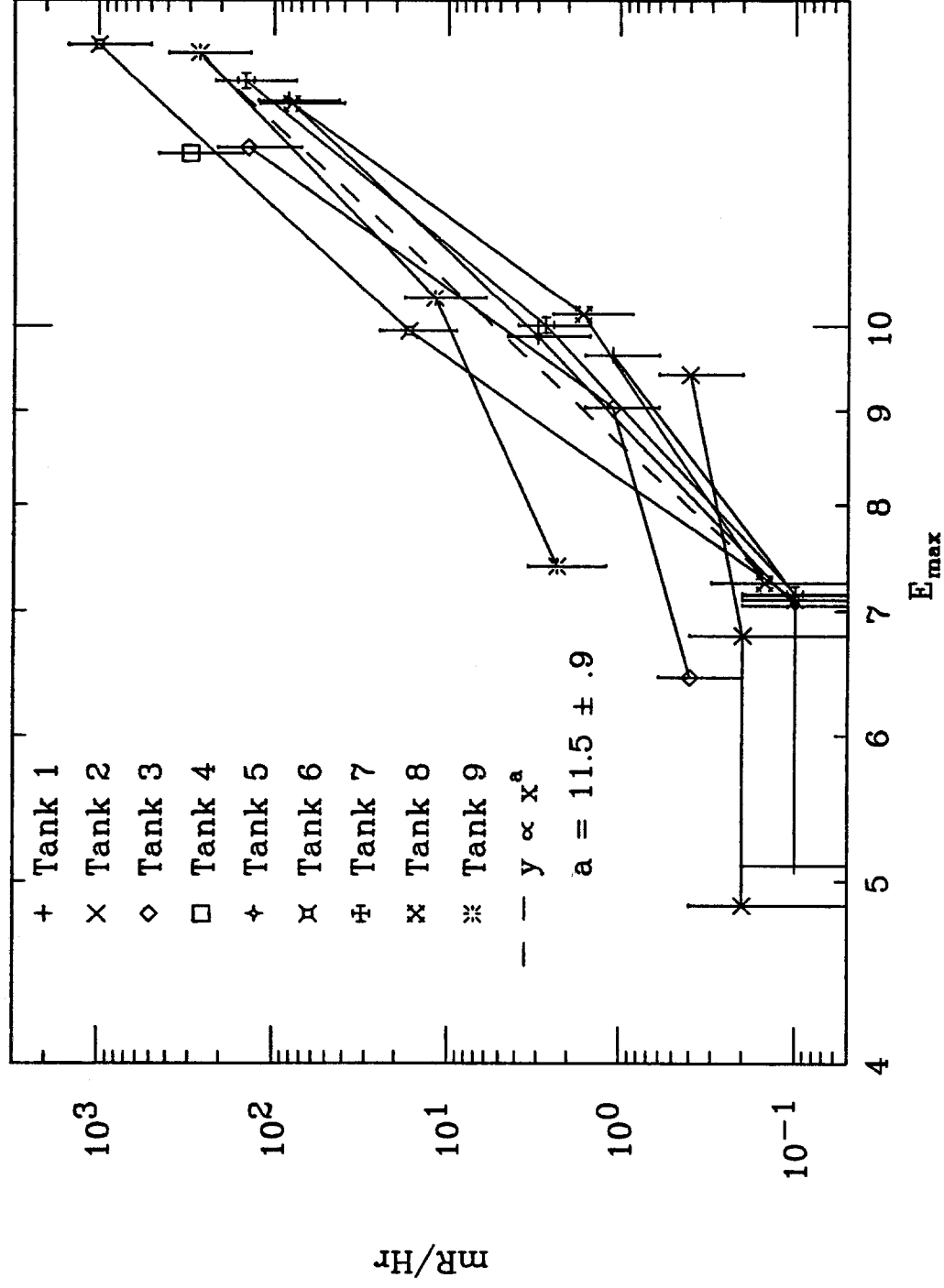


Figure 2

X-ray Radiation from Drift Tube Linac at 6 ft

3-OCT-1989 14:14

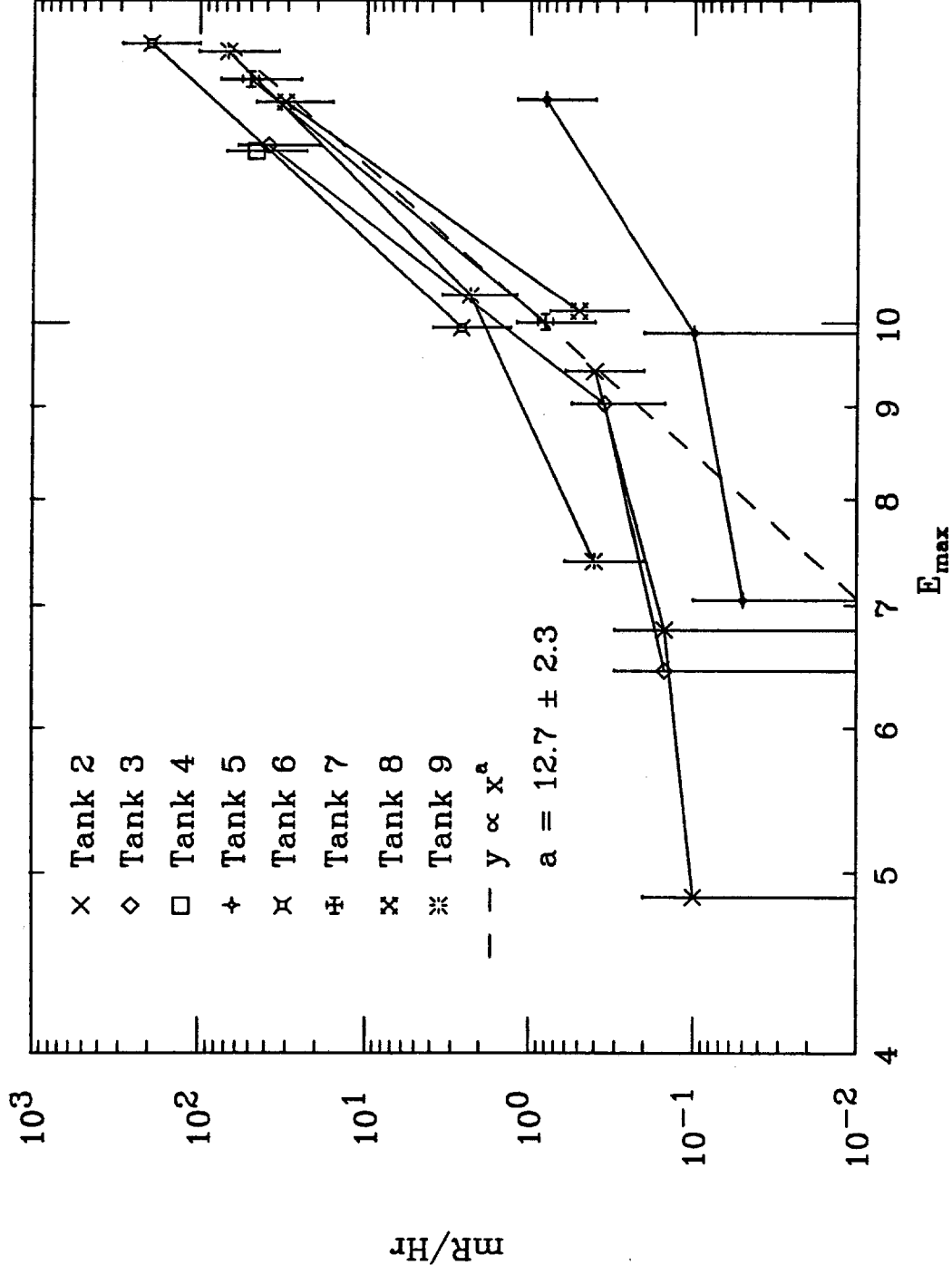


Figure 3